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MONTHLY  
MICROCLIMATIC SUMMARY

JANUARY 1967

ENVIRONMENTAL DATA BASE  
FOR REGIONAL STUDIES IN THE HUMID TROPICS

USATECOM Project No. 9-4-0013-01

US ARMY  
TROPIC TEST CENTER  
Fort Clayton, Canal Zone

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JANUARY 1967

Prepared by

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USATECOM Project No. 9-4-0013-01

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## MONTHLY MICROCLIMATIC SUMMARY

### Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N, 79° 33'W
Chiva Chiva	09° 01'N, 79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are employed in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semiannual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

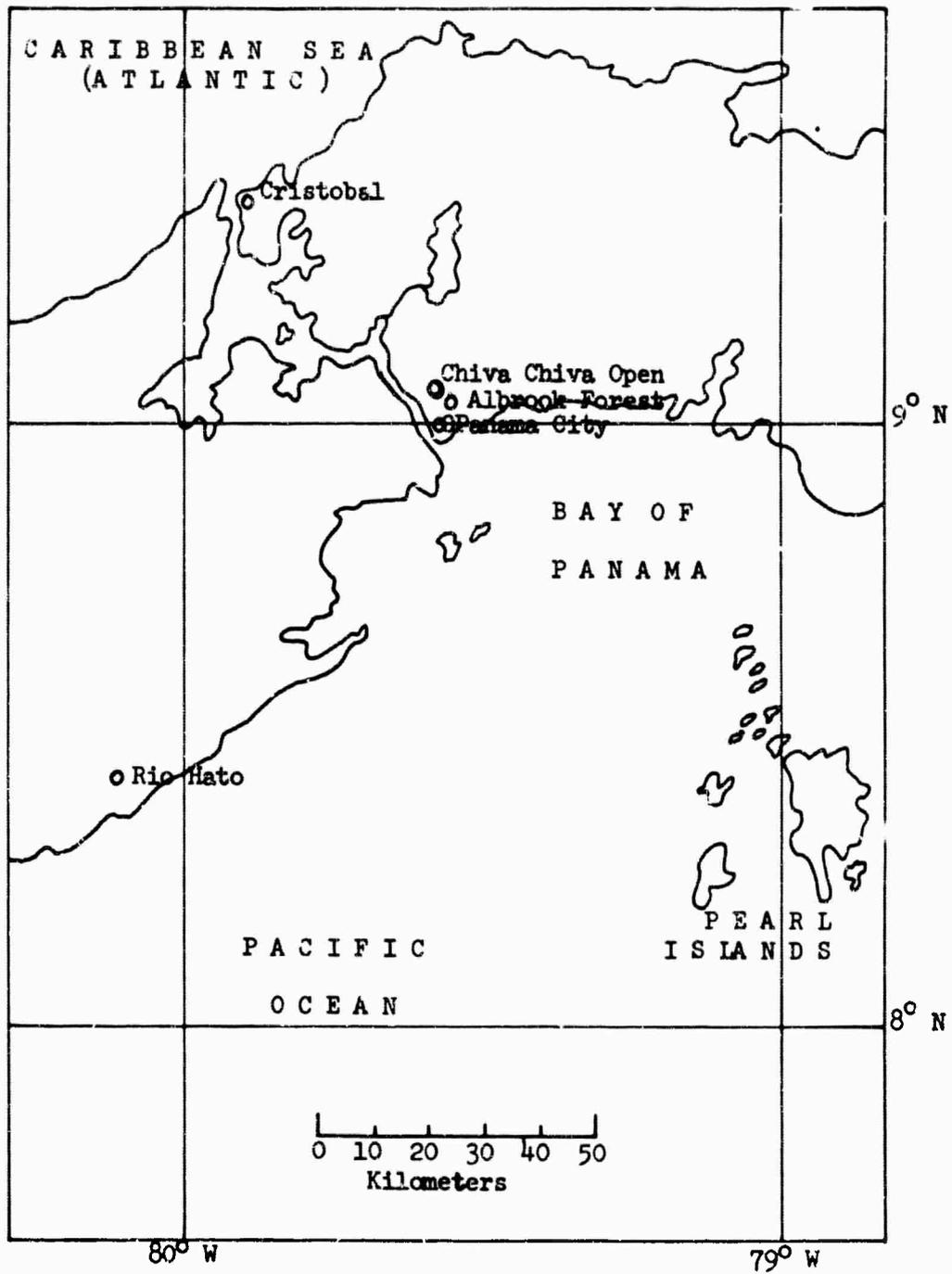


FIGURE 1. LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS

# Element	<u>Height (meters)</u>										<u>Frequency</u>	
	<u>Sfc</u>	<u>0.5</u>	<u>1.0</u>	<u>2.0</u>	<u>4.0</u>	<u>8.0</u>	<u>13.5</u>	<u>26.5</u>	<u>28.5</u>	<u>46.0</u>		
<u>Temperature:</u>												
Dry Bulb	-	1	1	1	1	2	1	1	-	-	1	Hourly*/Continuously
Wet Bulb	-	1	-	1	1	-	-	-	-	-	-	Hourly*/Continuously
Grass Minimum	3	-	-	-	-	-	-	-	-	-	-	Once Daily
<u>WBGT Index</u>	-	-	1	-	-	-	-	-	-	-	-	Hourly (0600-1900 EST)
<u>Relative Humidity</u>	-	1	1	1	1	-	1	1	-	-	1	Hourly*/Continuously
<u>Barometric Pressure</u>	-	-	1	-	-	-	-	-	-	-	-	Continuously
<u>Evaporation</u>	-	1	-	-	-	-	2	2	-	-	2	Once Daily
<u>Precipitation:</u>												
Recording Gage	-	-	1	-	-	-	-	-	-	-	2	Continuously
Manual Gage	-	-	2	-	-	-	-	-	-	-	-	4 Times Daily
Stem Flow	-	-	-	2	-	-	-	-	-	-	-	4 Times Daily
<u>Wind:</u>												
Direction	-	-	-	-	1	-	-	1	-	-	1	Continuously
Speed	-	-	-	3**	1	-	3**	1	-	-	1	Hourly**/Continuously

\* Observations made with sling psychrometer when recorders are inoperative.

\*\* Hourly

# Instrument descriptions are contained in the Environmental Data Base semiannual reports.

1. Albrook and Chiva Chiya
2. Albrook only
3. Chiva Chiya only

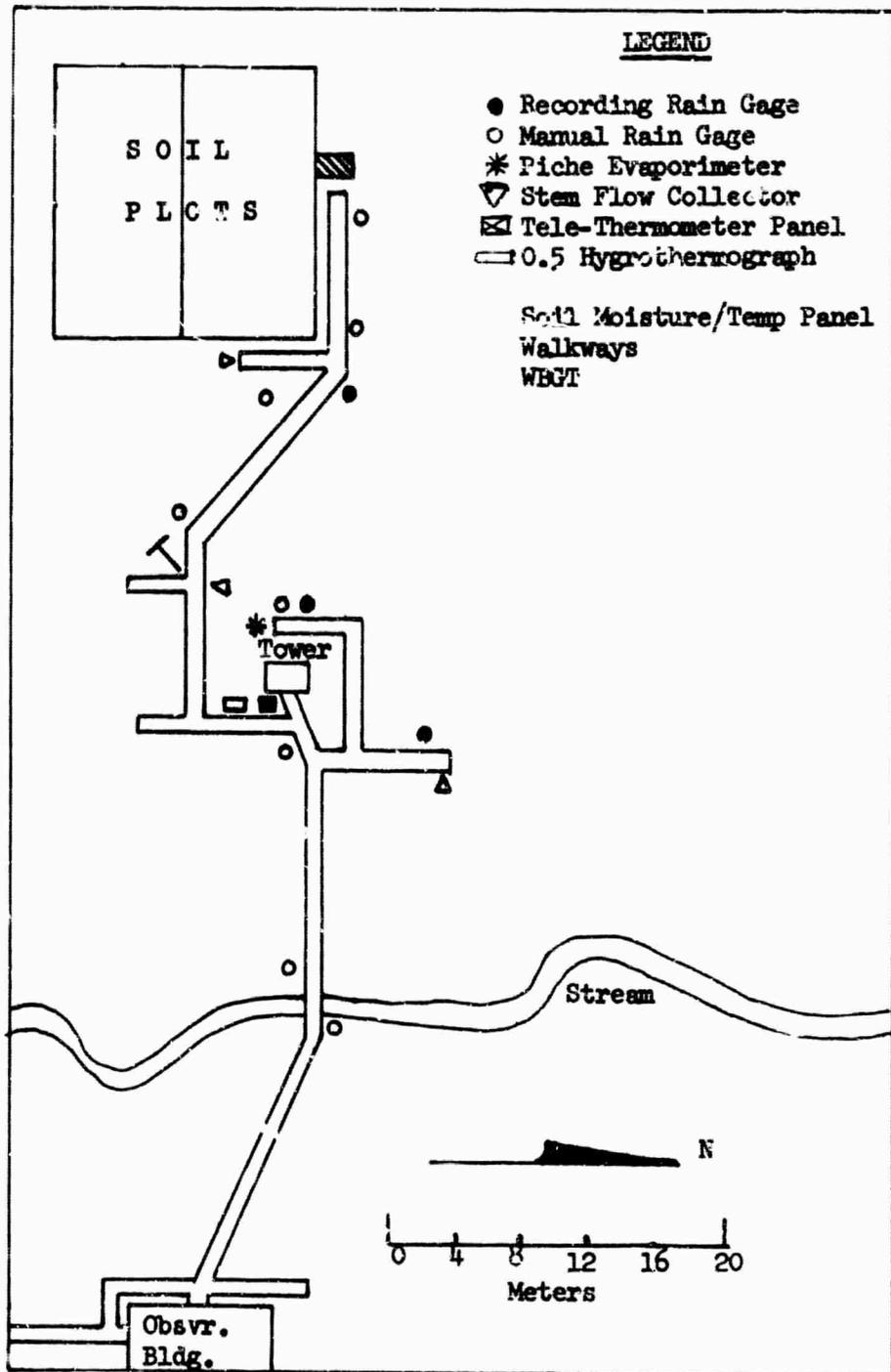


FIGURE 3. ALBROOK FOREST SITE, GENERALIZED PLOT

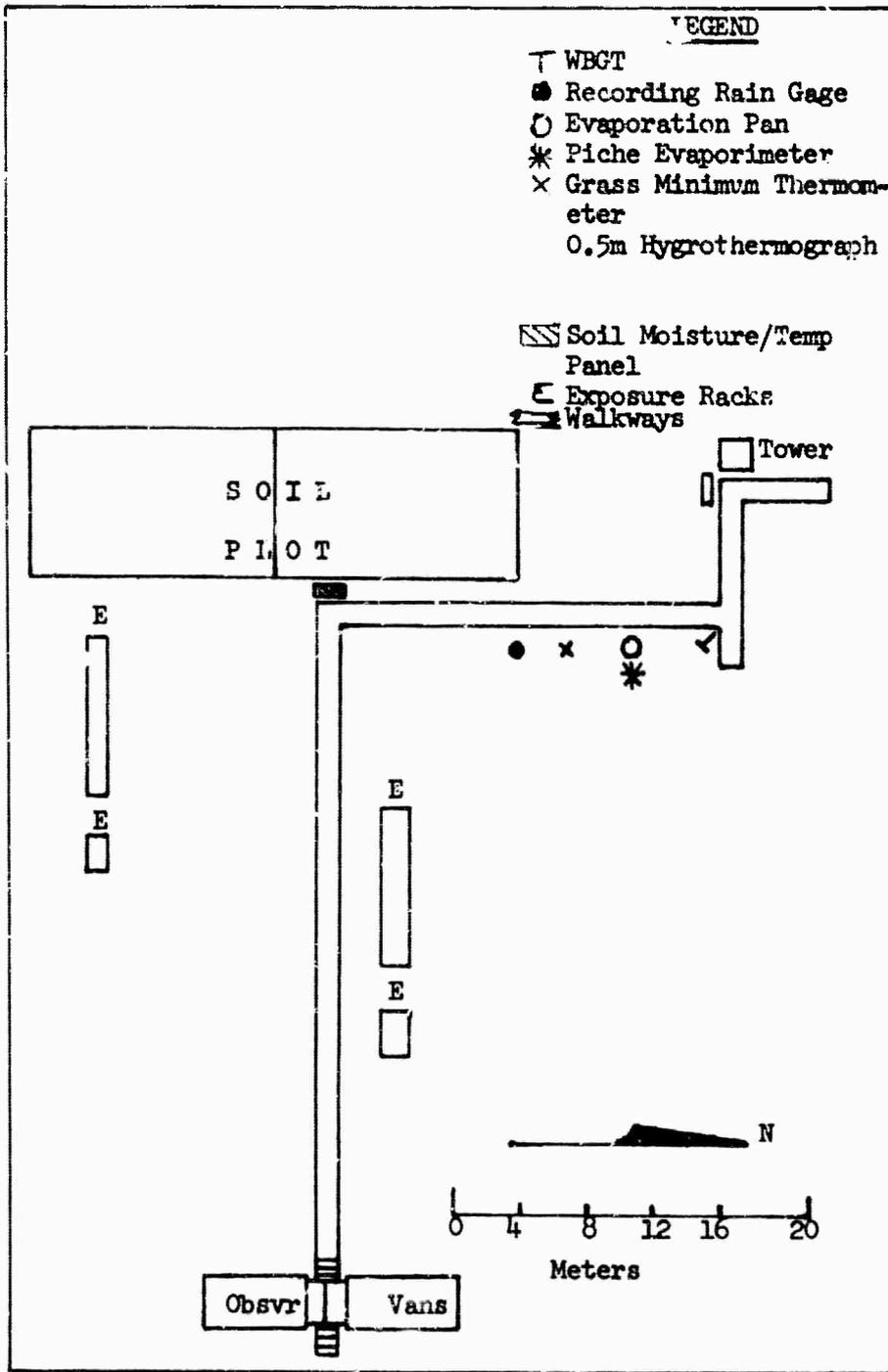


FIGURE 4. CHIVA CHIVA OPEN, GENERALIZED PLOT

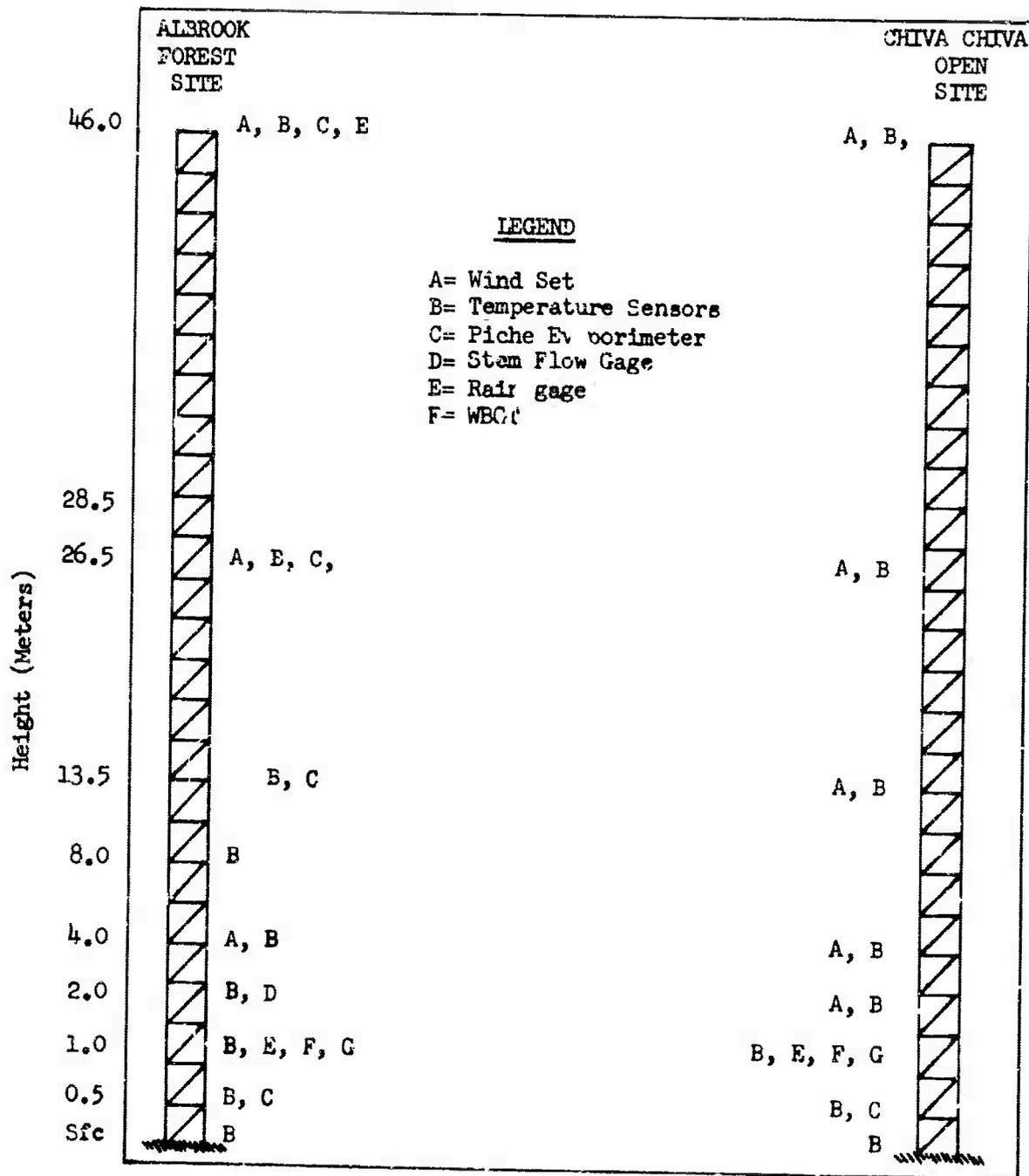


FIGURE 5. INSTRUMENT LOCATION ON TOWERS

**SUMMARY OF METEOROLOGICAL OBSERVATIONS:  
HOURLY DATA**

JANUARY 1967

Exposure	Monthly Means of Air Temperature by Hour (°F)																								Monthly Summary											
	Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Mean	Max.						
Albrook (Forest site)	46.0 m	74.9	74.7	74.5	74.4	74.2	74.2	74.7	76.8	80.6	82.7	84.0	84.9	85.6	85.3	85.0	83.7	82.3	82.3	90.1	77.8	76.7	76.0	75.5	75.0	74.9	744	71.7	78.7	89.2						
	28.5 m							This level was not instrumented for air temperature at this time																												
	26.5 m	74.5	74.3	74.0	73.9	73.6	73.5	73.8	76.3	80.8	83.3	84.8	85.6	86.1	86.2	86.0	84.7	83.6	83.6	81.0	77.9	76.6	75.7	75.3	74.9	74.6	744	69.1	78.8	89.1						
	13.5 m	74.1	73.9	73.6	73.4	73.3	73.0	72.9	74.9	78.5	81.2	83.2	84.5	85.0	85.3	84.6	83.5	82.5	82.5	80.1	77.8	76.5	75.6	74.9	74.5	74.2	744	69.3	78.0	88.2						
	8.0 m	73.5	73.2	73.1	72.6	72.6	72.5	72.4	74.8	78.6	81.2	82.9	83.9	84.6	84.5	83.8	82.9	81.5	81.5	78.9	76.5	75.5	74.7	74.3	73.8	73.5	743	69.1	77.3	87.9						
	4.0 m	73.1	72.8	72.5	72.2	72.3	72.0	72.1	74.7	78.6	81.1	82.7	83.6	84.6	84.3	84.0	82.8	81.0	81.0	78.1	76.2	75.0	74.2	73.9	73.4	73.1	744	69.0	77.0	87.8						
	2.0 m	73.0	72.7	72.4	72.2	72.2	72.0	72.0	74.5	78.2	80.5	82.3	83.3	84.3	84.1	84.0	82.7	80.8	80.8	78.1	76.2	74.9	74.1	73.3	72.3	73.1	744	69.0	76.9	87.7						
	1.0 m	73.2	73.0	72.8	72.5	72.4	72.1	72.2	74.5	78.2	80.7	82.4	83.6	84.5	84.9	83.9	82.8	81.1	81.1	78.4	76.2	75.5	74.7	74.1	73.8	73.4	744	69.2	77.1	91.0						
	0.5 m	73.5	73.2	73.0	72.7	72.6	72.4	72.3	74.0	77.3	79.7	81.6	83.0	83.7	83.8	83.8	82.8	81.3	81.3	79.0	76.9	75.7	74.9	74.3	73.9	73.5	742	70.0	77.0	86.7						

CP

Chiya Chiva (Open site)	46.0 m	75.1	75.0	74.9	74.8	74.7	74.6	74.9	76.2	79.3	81.4	83.0	84.0	84.5	84.5	84.2	83.3	82.1	82.1	80.2	77.9	76.9	76.2	75.9	75.5	75.3	743	72.3	78.5	86.7						
	28.5 m							This level was not instrumented for air temperature at this time																												
	26.5 m	75.1	74.9	74.8	74.7	74.5	74.3	74.4	76.3	79.6	81.8	83.4	84.5	84.9	85.0	84.6	83.9	82.7	82.7	80.6	78.3	77.3	76.4	76.0	75.6	75.4	744	71.4	78.7	86.9						
	13.5 m	74.9	74.7	74.6	74.5	74.3	74.1	74.2	76.4	80.1	82.2	83.7	84.7	85.2	85.3	84.9	84.0	82.7	82.7	80.6	78.2	77.1	76.3	75.9	75.5	75.2	744	70.2	76.7	87.6						
	8.0 m							This level was not instrumented for air temperature at this time																												
	4.0 m	74.3	74.0	74.1	74.0	73.7	73.2	73.9	78.4	81.3	84.1	85.2	86.3	86.7	86.6	85.9	84.7	82.9	82.9	79.7	77.3	76.2	75.4	75.0	74.8	74.6	744	69.5	78.8	89.9						
	2.0 m	73.8	73.6	73.7	73.7	73.2	72.5	73.6	78.8	82.0	84.8	86.3	87.5	87.8	87.7	86.7	85.4	83.6	83.6	79.7	77.2	76.0	75.2	74.8	74.4	74.1	744	68.8	79.0	90.4						
	1.0 m	72.8	73.5	73.5	73.3	73.0	72.3	73.5	79.2	82.7	85.6	87.0	88.6	88.8	88.6	87.4	85.5	83.5	83.5	79.6	76.9	76.5	75.5	74.9	74.4	74.1	744	68.5	79.2	93.0						
	0.5 m	73.4	73.3	73.1	73.1	72.8	72.4	73.2	80.0	84.6	87.4	88.8	90.3	90.0	90.1	88.5	86.5	84.2	84.2	79.5	77.0	75.8	75.0	74.5	74.1	73.7	744	68.9	79.6	94.9						

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
**JANUARY 1967**

Exposure	Monthly Ranges of Air Temperature by Hour (°F)																								Monthly Summary*
	Site	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
46.0 m	3.8	3.3	3.0	3.7	5.0	5.4	3.6	5.9	6.9	4.9	4.9	6.5	7.6	7.1	8.1	10.0	8.4	7.4	6.2	2.9	3.6	3.3	4.6	4.8	
28.5 m									This level was not instrumented for air temperature at this time																
26.5 m	3.7	3.9	5.1	7.0	7.5	8.0	6.3	7.4	6.9	5.5	5.4	7.1	6.1	7.5	8.6	10.9	10.8	10.0	6.2	4.2	3.8	3.0	4.2	4.3	
13.5 m	5.6	5.9	6.4	5.8	6.4	6.9	5.6	6.3	5.0	5.2	6.2	8.8	7.8	7.2	8.6	9.0	8.3	7.0	5.1	4.5	4.3	4.8	4.9	4.7	
8.0 m	4.9	5.6	5.6	5.6	5.4	5.6	6.1	5.5	5.3	6.6	7.4	10.8	7.0	7.9	9.1	8.9	8.3	10.2	5.1	4.9	5.1	4.9	5.2	4.7	
4.0 m	5.7	5.0	5.1	5.8	5.3	5.4	5.1	6.1	5.5	5.5	6.7	9.3	7.8	7.5	7.9	8.6	6.8	6.5	4.9	4.5	5.1	5.5	5.6	5.5	
2.0 m	5.9	5.5	5.0	5.2	5.8	5.5	5.4	5.8	5.2	5.5	7.0	9.7	8.3	7.2	7.5	8.7	6.6	5.7	5.0	4.5	5.0	5.2	5.3	5.7	
1.0 m	4.7	4.1	4.1	4.5	4.8	4.3	4.9	5.0	5.0	6.1	7.5	9.4	9.5	10.2	9.3	9.0	6.5	6.2	4.2	4.3	4.5	4.9	5.1	4.9	
0.5 m	6.2	5.2	5.0	4.2	4.2	5.0	5.3	5.4	3.8	4.0	7.4	7.0	7.2	6.6	6.6	7.8	7.2	5.8	4.8	3.7	3.8	4.8	5.4	5.6	

\* No monthly summary was computed for the ranges.

46.0 m	2.6	3.4	3.4	3.7	3.8	4.1	3.6	3.3	3.8	5.1	3.7	3.8	4.4	6.0	4.9	8.3	7.7	7.4	6.8	4.7	3.3	3.3	3.8	3.8	3.7	
28.5 m									This level was not instrumented for air temperature at this time																	
26.5 m	3.9	3.4	3.6	3.6	5.1	5.1	5.0	4.7	5.8	4.9	4.6	3.8	4.9	5.9	5.0	8.1	8.2	8.3	8.1	5.1	3.9	3.4	3.9	4.3	4.1	
13.5 m	3.5	4.0	5.0	5.0	5.4	6.7	6.3	6.1	5.4	4.6	4.0	4.2	4.5	6.6	5.9	8.1	7.6	7.2	6.6	6.2	4.0	3.4	3.2	3.5	3.4	
8.0 m									This level was not instrumented for air temperature at this time																	
4.0 m	5.7	5.7	6.6	6.6	6.5	5.8	5.8	6.6	7.6	5.9	5.3	7.0	7.8	8.1	10.9	10.7	9.1	6.5	4.2	4.5	4.7	4.3	4.9	6.2		
2.0 m	5.6	5.7	6.3	6.2	7.6	7.4	6.0	7.2	7.8	6.0	6.3	7.5	8.1	8.0	11.1	9.1	9.1	6.3	4.4	4.4	5.5	4.9	5.8	5.6		
1.0 m	4.8	4.8	5.5	5.7	6.5	6.5	8.7	10.6	9.2	8.3	10.0	9.0	10.0	13.2	10.3	8.9	8.9	6.2	6.4	3.8	4.6	4.0	4.6	4.8		
0.5 m	6.0	6.4	6.7	6.1	7.1	7.3	6.2	7.5	10.8	9.7	10.8	13.9	15.4	10.6	10.1	10.5	9.0	6.4	4.0	3.6	5.1	4.6	4.8	5.6		



**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
JANUARY 1967

Exposure	Monthly Ranges of Relative Humidity by Hour (%)																								Monthly Summary*
	Site	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
46.0 m	12	9	10	13	7	20	15	18	27	27	29	32	34	30	35	35	34	26	20	17	9	11	12	13	
28.5 m	12	13	9	14	17	16	13	18	30	22	22	28	32	31	31	40	31	25	26	16	11	12	11	12	
26.5 m	9	12	10	8	11	11	7	11	24	25	30	38	35	32	42	38	40	28	25	20	15	10	9	9	
13.5 m	This level was not instrumented for relative humidity at this time																								
8.0 m	This level was not instrumented for relative humidity at this time																								
4.0 m	12	13	10	9	8	9	11	13	24	28	37	47	39	40	41	44	37	26	24	19	15	13	14	12	
2.0 m	10	12	9	8	8	9	10	11	23	29	35	46	39	37	39	43	32	29	22	19	14	13	13	9	
1.0 m	7	9	8	8	6	6	6	9	22	30	31	36	32	29	37	37	27	22	16	12	10	8	7	8	
0.5 m	13	11	11	10	10	6	8	8	17	25	53	38	36	36	37	38	34	26	21	18	12	15	12	12	

\* No monthly summary was computed for the ranges.

46.0 m	16	16	12	16	14	20	20	12	18	17	16	16	27	29	29	33	35	31	27	20	14	14	16	16	18	
28.5 m	This level was not instrumented for relative humidity at this time																									
26.5 m	17	16	10	14	14	18	14	13	19	18	20	26	32	30	34	35	32	26	22	15	15	18	17	18		
13.5 m	16	13	13	17	14	17	16	14	19	17	20	27	32	31	34	35	32	25	20	16	16	18	19	20		
8.0 m	This level was not instrumented for relative humidity at this time																									
4.0 m	18	15	13	16	17	15	17	20	28	18	19	29	33	31	32	34	35	27	23	19	18	14	16	19		
2.0 m	16	11	12	13	14	12	13	20	29	23	21	27	34	33	33	34	37	25	25	20	19	20	19	20		
1.0 m	13	11	13	14	14	12	13	23	28	22	22	32	38	33	34	36	33	26	17	13	11	14	18	16		
0.5 m	11	12	13	11	13	14	12	23	33	22	25	40	43	31	27	40	33	24	22	16	12	14	18	19		

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**

JANUARY 1967

Exposure Site	Monthly Means <sup>2</sup> of other Elements by Hour																								Monthly Summary			
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ng of obs.	Mean	Max.	
Albrook (forest site)	WB (4.0 m)	71.9	71.8	71.6	71.5	71.5	71.4	73.3	74.8	75.0	75.3	75.0	74.9	75.2	75.6	75.1	74.6	73.5	72.8	72.4	72.3	72.1	72.0	71.9	744	68.0	73.2	80.0
	W8 (2.0 m)	72.0	71.7	71.6	71.5	71.5	71.4	73.3	75.0	75.4	75.5	75.4	75.3	75.4	75.9	75.5	75.0	73.9	73.0	72.5	72.3	72.2	72.1	71.9	744	68.0	73.4	79.5
	W8 (0.5 m)	72.2	72.0	71.8	71.7	71.6	71.5	73.0	75.2	75.9	76.2	76.3	76.2	76.2	76.4	76.2	75.8	74.9	73.7	73.1	72.7	72.5	72.3	72.1	730	68.8	73.8	80.6
	RP	.728	.714	.700	.695	.700	.711	.733	.755	.770	.773	.762	.739	.712	.688	.666	.662	.667	.678	.700	.715	.735	.746	.747	.743	744	.620	.718
P1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.03	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5	0.01	0.51	0.38
P2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.26	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	0.01	0.33	0.26
P3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.30	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	0.01	0.37	0.30
P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.31	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	0.01	0.41	0.31

21

Chiva Chiva (Open site)	WB (4.0 m)	72.2	72.0	72.0	71.7	71.5	72.1	74.2	74.8	75.1	75.1	75.0	75.2	75.1	75.0	74.7	74.5	73.3	72.8	72.6	72.5	72.4	72.4	72.3	744	69.2	73.4	79.9	
	W8 (2.0 m)	71.9	71.7	71.7	71.8	71.5	71.1	71.9	74.4	75.1	75.5	75.6	75.6	75.5	75.3	75.0	74.5	73.3	72.7	72.5	72.3	72.2	72.0	71.9	743	68.2	73.4	78.5	
	WB (0.5 m)	71.7	71.6	71.6	71.5	71.3	71.1	71.8	74.9	76.3	76.8	77.0	77.2	76.9	76.8	76.4	75.8	75.1	73.5	72.7	72.5	72.3	72.2	72.0	71.8	744	68.7	73.8	79.3
	RP	.813	.799	.785	.782	.786	.800	.818	.841	.860	.863	.854	.831	.808	.777	.756	.753	.757	.768	.788	.804	.825	.835	.834	.829	744	.705	.807	.915
PS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	0.02	0.11	0.09	

WB - Wet bulb temperature (°F)  
 W8 - Barometric pressure (in. of Hg minus 29.0)  
 RP - Precipitation at 1.0 m. in open area (in.)  
 P1 - Precipitation at 46.0 m. above canopy (in.)  
 P2 - Precipitation under full canopy (in.)  
 P3 - Precipitation under drip canopy (in.)  
 P4 - Precipitation under open canopy (in.)

<sup>2</sup> Monthly means of precipitation are computed for precipitation days. Precipitation totals are substituted for the mean in the monthly summary.

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
 JANUARY 1967

Exposure	Site (Code)	Monthly Ranges <sup>2</sup> of other Elements by Hour																								Monthly Summary*
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Albrook (Forest site)	WB (4.0 m)	4.5	4.3	4.0	4.0	5.0	5.5	4.9	3.3	4.0	3.8	4.9	5.8	5.7	6.2	7.2	8.2	7.1	5.7	4.9	4.2	3.8	4.0	4.7	4.5	
	WR (2.0 m)	4.1	4.5	4.3	4.5	5.0	5.5	5.1	3.5	3.3	4.0	5.3	6.0	5.2	5.7	6.1	7.8	6.0	5.1	4.5	4.2	4.1	4.1	4.4	4.2	
	WB (0.5 m)	4.4	4.5	4.9	5.1	5.3	5.5	5.8	4.9	3.0	3.7	4.9	8.2	5.4	5.7	6.2	6.2	6.0	6.0	4.8	4.5	4.3	4.2	3.8	4.4	
	BP	.090	.095	.095	.100	.110	.105	.110	.100	.095	.090	.115	.105	.105	.120	.085	.090	.100	.115	.115	.110	.120	.115	.110	.095	
Chiva Chiva (Open site)	WB (4.0 m)	3.7	3.7	4.0	3.0	4.2	3.7	4.4	3.1	2.8	4.2	4.2	5.1	5.2	5.9	8.0	7.4	8.2	5.2	5.0	5.1	4.2	3.8	4.1	4.4	
	WB (2.0 m)	4.2	3.8	4.0	3.5	5.5	5.0	4.2	2.8	2.7	4.5	4.5	4.5	5.0	6.3	6.0	4.8	6.5	5.5	5.0	5.1	4.5	4.1	4.5	4.5	
	WB (0.5 m)	3.5	3.9	4.4	3.7	4.6	4.6	3.6	3.5	3.0	3.3	3.8	3.4	3.2	3.4	3.0	3.5	4.6	4.0	3.9	3.9	3.5	3.4	4.1	4.3	
	BP	.100	.090	.090	.090	.110	.105	.100	.100	.100	.095	.100	.100	.095	.100	.090	.095	.115	.120	.140	.130	.115	.110	.105	.100	
PS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

\* No monthly summary was computed for the ranges.

WB - Wet bulb temperature (°F)  
 BP - Barometric pressure (in. of Hg minus 29.0)  
 PS - Precipitation at 1.0 m. In open area (in.)  
 P1 - Precipitation at 46.0 m. above canopy (in.)  
 P2 - Precipitation under full canopy (in.)  
 P3 - Precipitation under drip canopy (in.)  
 P4 - Precipitation under open canopy (in.)

<sup>2</sup>Monthly ranges of precipitation are computed for precipitation days.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JANUARY 1967

Exposure	Monthly Means of Wind Speed by Hour (miles/hr.)																								Monthly Summary						
	Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Mean	Max.	
Albrook (Forest site)	46.0 m	6	5	5	5	6	6	6	5	6	8	10	9	9	10	8	9	7	6	6	6	6	5	5	6	6	712	0	7	22	
	28.5 m		This level was not instrumented for wind speed at this time																												
	26.5 m	1	1	1	1	1	2	2	2	2	3	3	3	3	4	2	3	2	2	2	2	2	1	2	2	2	2	710	0	2	17
	13.5 m		This level was not instrumented for wind speed at this time																												
	8.0 m		This level was not instrumented for wind speed at this time																												
	4.0 m	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	1	0	1	0	0	0	0	1	1	709	0	0	6
2.0 m		This level was not instrumented for wind speed at this time																													
1.0 m		This level was not instrumented for wind speed at this time																													
0.5 m		This level was not instrumented for wind speed at this time																													

Chiva Chiva (Open site)	46.0 m	7	7	8	7	7	7	7	7	9	11	12	13	13	14	13	12	11	10	8	8	9	8	8	8	7	741	0	9	25
	28.5 m		This level was not instrumented for wind speed at this time																											
	26.5 m	6	6	7	6	5	5	5	6	8	11	11	13	13	14	13	12	11	9	8	8	7	7	6	6	6	725	0	8	24
	13.5 m	3	3	3	3	2	2	2	4	7	11	13	14	14	14	14	12	10	8	5	5	5	4	4	4	4	744	0	7	30
	8.0 m		This level was not instrumented for wind speed at this time																											
	4.0 m	3	3	4	4	3	3	3	5	7	9	10	10	10	12	10	10	8	7	5	5	5	4	4	4	4	722	0	6	19
2.0 m	1	2	2	2	1	1	1	3	5	7	8	9	9	10	9	8	7	4	3	3	3	2	2	2	2	744	0	4	16	
1.0 m		This level was not instrumented for wind speed at this time																												
0.5 m		This level was not instrumented for wind speed at this time																												

# SUMMARY OF METEOROLOGICAL OBSERVATIONS

## HOURLY DATA

JANUARY 1967

Exposure	Monthly Ranges of Wind Speed by Hour (miles/hr.)																								Monthly Summary*		
	Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22		23	24
Albrook (Forest site)	46.0 m	11	12	11	10	13	10	11	11	16	16	19	13	20	22	17	16	11	9	8	10	10	9	11	11		
	28.5 m	This level was not instrumented for wind speed at this time																									
	26.5 m	5	5	5	5	4	5	6	5	11	8	14	10	10	17	5	7	10	9	4	4	5	5	5	7		
	13.5 m	This level was not instrumented for wind speed at this time																									
	8.0 m	This level was not instrumented for wind speed at this time																									
	4.0 m	3	3	3	3	1	3	1	1	2	2	3	4	4	4	4	3	2	2	4	1	1	2	1	6	4	
	2.0 m	This level was not instrumented for wind speed at this time																									
1.0 m	This level was not instrumented for wind speed at this time																										
0.5 m	This level was not instrumented for wind speed at this time																										

\* No monthly summary was compiled for the ranges.

46.0 m	13	11	16	12	12	12	12	12	10	13	21	15	19	19	15	14	13	11	11	10	9	10	12	14	15	
28.5 m	This level was not instrumented for wind speed at this time																									
26.5 m	10	13	16	9	10	11	12	11	13	14	13	22	19	15	14	15	12	12	9	8	14	11	13	14		
13.5 m	11	24	9	11	7	6	6	6	12	19	22	29	25	24	20	22	20	14	20	15	12	17	17	10	16	
8.0 m	This level was not instrumented for wind speed at this time																									
4.0 m	7	10	10	9	9	6	9	6	8	11	10	14	18	14	13	11	13	12	7	6	8	9	9	9		
2.0 m	6	10	7	6	6	4	5	8	11	14	14	18	15	16	12	15	15	13	10	6	10	6	7	12		
1.0 m	This level was not instrumented for wind speed at this time																									
0.5 m	This level was not instrumented for wind speed at this time																									

ALBROOK (Forest site) JANUARY 1967

Relative Frequencies\* of Wind Directions by Hour at 46.0 m.  
( % )

Hr. Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
N			3.3			3.4			10.4	27.4	37.8	39.9	13.3	26.6	27.5	20.0	13.3	3.3	6.6		6.6	3.3	3.4		
NNE	3.3						3.4			10.4	6.8	10.0	6.6	3.3	3.4	3.3	3.3								
NE									3.4		6.8	3.3				6.6									
ENE										3.4		3.3													
E																									
ESE																									
SE																									
SSE									3.4			3.3		3.3											
S																									
SSW		3.3								3.4	3.4														
SW															3.4	3.3									
WSW	3.3	3.3	6.6	3.3	3.3			6.8			3.4		3.3	6.6		6.6			3.3			3.3			3.3
W	56.4	49.8	49.8	49.8	59.8	61.9	65.4	55.0	20.7		13.8	3.3	16.6	10.0	17.2	26.6	20.0	20.0	16.6	53.1	49.8	59.8	65.4	73.1	
WNW	20.0	16.6	23.3	26.6	13.4	20.9	17.3	10.4	10.4	17.2	3.4	3.3	10.0	10.0	3.4	13.3	10.0	20.0	23.3	13.3	23.3	16.6	3.4	6.6	
NW	10.0	10.0	6.6	10.0	10.0	3.4	6.8	17.2	17.2	20.8	6.8	20.0	33.2	20.0	13.8	16.6	29.9	33.2	29.9	23.3	13.3	10.0	10.4	13.3	
NNW	3.3	3.3	3.3	6.6		3.4			17.2	10.4	20.8	13.3	13.3	16.6	24.2	10.0	16.6	23.3	16.6	6.6			10.4		
CALM	3.3	6.6	6.6	3.3	10.0	6.8	6.8	10.4	10.4	6.8			3.3	3.3	6.8					3.3	3.3	6.6	3.4	3.3	

\* Note: Due to rounding, percentage totals do not equal 100%.

ALBROOK (Forest site) JANUARY 1967

Relative Frequencies\* of Wind Directions by Hour at 20.5 m.  
(%)

Hr. Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N							3.4		10.4	3.5	17.7	10.0	10.0	16.6	10.4	6.6	10.0	6.6	3.3	3.3				3.4
NNE									3.4	3.5	3.5	16.6		6.6	6.8	6.6	3.3	5.6	3.3					
NE										21.4	17.9	3.3	10.0	6.6	3.4	10.0	3.3	6.6				2.3		
ENE													3.3		10.4	6.6	3.3		3.3					
E										3.5					3.4		3.3							
ESE											3.5			3.3										
SE												3.3												
SSE													3.3	3.3										
S												3.3	3.3	3.3										
SSW										3.5														
SW											3.5	3.3				3.3								
WSW													3.3		3.4	3.3				3.3	3.3			3.4
W	10.0	10.0	3.3	6.6	10.0	20.8	17.2	13.8	6.8			3.3	10.0	3.3	6.8		10.0	10.0	6.6	6.6	13.2	10.0	3.4	10.0
WNW	23.3	23.3	26.6	13.3	16.6	10.4	17.2	10.4	6.8	3.5	3.5	6.6	3.3	13.3	3.4	20.0	10.6	3.3	10.0	10.0	13.3	26.6	31.0	23.3
NW	3.3	3.3	6.6	6.6	10.0	6.3	10.4	17.2	13.8	17.9	17.9	16.6	20.0	13.3	13.8	23.3	26.6	13.3	20.0	33.2	23.3	10.3	10.4	6.6
NNW	3.3						6.8	6.8	3.4	10.8	3.5	6.6	10.0	6.6	10.4	3.3		6.6	13.3	6.6		3.3		6.6
CALM	59.8	63.1	59.8	69.7	63.1	61.8	44.7	48.2	48.2	32.1	28.7	26.6	26.6	23.3	27.5	16.6	29.9	46.6	39.9	35.6	46.6	46.6	48.3	53.1

\* Note: Due to rounding, percentage totals do not equal 100%.

TABLE NO. 6. A. 11111

ALBROOK (Forest site) JANUARY 1967

Relative Frequencies\* of Wind Directions by Hour at 4.0 m.  
(%)

Hr. Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	3.3		3.3		3.3		3.4	6.9	6.9	6.9	3.4	10.0	6.6	3.3	3.4	6.6	13.3	10.0	3.3		10.0	6.6		
NNE				3.3							6.9	6.6			3.4			6.6	6.6	3.3				
NE												3.3	6.6	10.0	3.4			3.3	3.3	3.3				
ENE								3.4	6.9					6.6			3.3							
E									6.9	3.4	3.4		10.0	6.6	6.9	6.6								
ESE												3.3	3.3		6.9									
SE									3.	6.9	6.6	6.6	3.3	6.6		6.6								
SSE										3.4					3.4									
S										3.4	10.0	3.3	3.3	3.3		3.3	3.3	3.3						3.3
SSW				3.3					3.4	10.4	3.3	6.6	6.6	3.4			6.6				3.3			
SW				3.3					3.4	3.4	3.3	3.3	3.3	3.3	3.4	3.3	3.3	3.3	3.3			3.3		
WSW									3.4				3.3	3.3			3.3	3.3						3.3
W	3.3	6.6	5.3	3.3	3.3	3.4	3.4			6.9	3.4	3.3	3.3	3.3	2.4	3.3	3.3	10.0	3.3	10.0	3.3		10.4	10.0
WNW	10.0	3.3	6.6	3.3		6.9			3.4	10.4		3.3	3.3			6.6	3.3			6.6	6.6	6.6	6.9	3.3
NW	13.3	10.0	13.3	20.0	26.6	17.2	13.8	6.9	6.9			3.3			3.4	6.6	3.3	10.0		6.6	3.3	16.6	3.4	10.0
NNW	3.3		6.6			10.4		3.4			3.4			10.0							3.3	3.3	13.8	10.0
CALM	66.4	79.7	66.4	63.1	66.4	61.9	79.0	82.4	68.8	58.4	51.6	43.2	46.6	46.6	58.6	56.6	59.8	59.8	69.7	69.7	69.7	63.1	61.9	59.8

\* Note: Due to rounding, percentage totals do not equal 100%.

CHIVA CHIVA (Open site) JANUARY 1967

Relative Frequencies\* of Wind Directions by Hour at 46.0 m.  
(%)

Hr \ Dir	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	25.8	22.6	25.8	19.4	22.6	19.4	9.7	19.4	38.7	32.2	35.5	29.0	25.8	26.6	38.7	45.2	32.2	29.0	38.7	16.1	16.6	23.3	25.8	16.1
NNE	3.2	3.2				6.4	6.4			22.6	19.4	19.4	16.1	13.3	16.1	9.7	12.9	5.2	3.2	3.2				3.2
NE										12.9	6.4	9.7	12.9		3.2	3.2		3.2						
ENE										3.2														3.2
E																					3.3			
ESE	3.2																							
SE										3.2	3.2													
SSE																								
S													3.2											6.4
SSW																								
SW		3.2																						
WSW				3.2																				
W								9.7				3.2									3.3	3.3	3.2	
WNW		6.4	3.2	6.4	9.7	3.2	6.4	3.2		3.2			3.2	3.3	3.2	3.2	12.9					3.3	3.2	3.2
NW	19.4	12.9	16.1	32.2	38.7	29.0	45.2	25.8	12.9		12.9		9.7	20.0	9.7	12.9	9.7	22.6	22.6	35.5	26.6	33.2	29.0	29.0
NNW	48.4	51.6	48.4	38.7	25.8	35.5	29.0	41.9	48.4	25.8	22.6	35.5	29.0	36.6	29.0	25.8	32.2	41.9	25.5	45.2	49.8	55.6	38.7	38.7
CALM			3.2				3.2																	

\* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA S A 11111

CHIVA CHIVA (Open site) JANUARY 1967

Relative Frequencies\* of Wind Directions by Hour at 26.5 m.  
(%)

Hr	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	36.6	29.9	49.8	43.2	29.9	33.2	23.3	26.6	66.4	35.5	25.8	22.6	25.8	49.8	45.2	48.4	46.6	43.2	53.2	59.8	55.0	58.4	49.8	39.9
NNE	13.3	20.0	6.6	3.3	13.3	6.6	6.6	6.6	13.3	19.4	25.8	32.2	29.0	16.6	22.6	19.4	16.6	20.0	20.0	3.3	6.8	3.4	3.3	10.0
NE							10.0	3.3	3.3	29.0	25.8	29.0	19.4	16.6	19.4	12.9	6.6	3.3	6.6	6.6	3.4			3.3
ENE										3.2			6.4		3.2	3.2		3.3						3.3
E	3.3			3.3						3.2		3.2									3.4			3.3
ESE																								
SE	3.3	3.3				3.3					3.2													3.3
SSE																								
S												3.2												
SSW							3.3																	
SW	3.3			3.3	3.3				3.3															
WSW																								
W		3.3		3.3		6.6															3.4			
WNW				3.3	3.3			3.3									3.3				3.4	5.4	3.3	
NW	10.0	3.3	16.6	13.3	6.6	10.0	23.3	3.3	3.3	6.4		3.2	9.7	6.6	6.4	13.3	6.6	3.3	13.2			17.2	10.0	10.0
NNW	29.9	36.6	20.0	26.6	39.9	36.6	29.9	49.8	10.0	3.2	11.4	6.4	9.7	10.0	3.2	9.7	13.3	23.3	16.6	16.6	24.2	17.2	23.3	23.3
CALM		3.3	6.6		3.3	3.3	3.3	3.3															6.6	3.3

\* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA S. A. 41111

CHIVA CHIVA (Open site) JANUARY 1967

Relative Frequencies\* of Wind Directions by Hour at 4.0 m.  
( % )

Hr. Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	6.4	19.4	19.4	12.9	6.4	6.4	3.2	12.9	29.0	48.4	45.2	29.0	22.5	36.6	29.0	32.2	45.2	29.0	32.2	16.1	10.0	20.0	16.1	19.4
NNE	3.2		6.4	9.7	12.9		9.7	3.2	12.9	3.2	16.1	22.6	12.9	13.3	3.2	12.9	3.2	6.4	3.2	3.2				9.7
NE		3.2	3.2		6.4		9.7	3.2		16.1	12.9	16.1	19.4	3.3	16.1		6.4				13.3	2.3		6.4
ENE						16.1															3.3			9.7
E				3.2																			3.2	3.2
ESE	3.2	3.2			3.2						3.2													
SE	3.2	3.2																						
SSE																								
S			3.2					3.2				3.2												
SSW																3.2								
SW																						3.3		3.2
WSW																	3.2							
W	3.2	3.2		3.2	3.2	3.2	3.2	6.4		3.2		3.2					3.2			3.2	3.3	6.6	3.2	
WNW	9.7	9.7	3.2	3.2			16.1	6.4	3.2	3.2			6.4		9.7	3.2	3.2	9.7				3.2		9.7
NW	22.6	22.6	32.2	35.5	29.0	32.2	35.5	35.5	25.8	3.2	12.9	9.7	19.4	23.3	9.7	12.9	12.9	19.4	32.2	38.7	20.0	39.9	32.2	9.7
NNW	41.9	19.4	25.8	25.8	29.0	29.0	12.9	25.8	29.0	22.6	9.7	16.1	19.4	23.3	32.2	35.5	22.6	35.5	32.2	38.7	49.8	26.6	32.2	32.2
CALM	6.4	9.7	6.4	6.4	6.4	9.7	9.7	3.2															6.4	

\* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA S. A. 1965

# SUMMARY OF NON HOURLY DATA

JANUARY 1967

Summary of Elements with 1-hourly Frequencies of Observation						
Site	Element, Units and Exposure	Description	Nu of obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	WBGT Index <sup>1</sup> (at 1.0 meters)	Index value	434	63.8	76.6	82.5
		Dry bulb temp.	434	69.2	79.7	91.0
		Wet bulb temp.	434	68.5	75.1	91.0
		Black bulb temp.	434	69.8	80.3	96.8
	Evaporation <sup>3</sup> (in. at 4 levels)	Piche (46.0 m)	31	0.189	15.971*	0.762
		Piche (26.5 m)	31	0.129	11.092*	0.500
		Piche (13.5 m)	31	0.355	5.147*	0.250
		Piche ( 0.5 m)	31	0.030	3.019*	0.135
	Precipitation from Raingauge Network <sup>2</sup> (in. at 1.0 meters)	Gauge # 1	4	0.01	0.41*	0.33
		Gauge # 2	5	0.01	0.41*	0.34
		Gauge # 3	5	0.01	0.53*	0.41
		Gauge # 4	3	0.01	0.36*	0.32
		Gauge # 5	4	0.01	0.41*	0.33
Gauge # 6		4	0.01	0.37*	0.30	
Gauge # 7		4	0.01	0.46*	0.35	
Gauge # 8		3	0.01	0.30*	0.25	
Stem Flow <sup>2</sup> (in. at 2.0 meters)	Small tree	2	0.02	0.36*	0.34	
	Medium tree	2	0.01	0.49*	0.48	
	Large tree	1	0.14	0.14*	0.14	
Chiva Chiva (Open site)	WBGT Index (at 1.0 meters)	Index value	434	68.0	79.5	86.9
		Dry bulb temp.	434	68.5	82.8	93.0
		Wet bulb temp.	434	68.0	75.3	93.0
		Black bulb temp.	428	67.9	92.4	112.8
	Evaporation <sup>3</sup> (in. at 0.5 meters)	Piche	24	0.116	8.869*	0.512
		Pan	38	0.054	9.366*	0.531
Minimum Grass temp <sup>3</sup> (°F at grass tips)	None	30	63.5	67.2	70.0	

- 1 - Hourly observations between 0600 and 1900 hours inclusive  
 2 - Six hourly observations  
 3 - Daily observations

\*Total Values

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<p>This report contains detailed microclimatic data for January 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.</p>			

14. KEY WORDS	LINK A		LINK B		LINK C	
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